

Natalie Behague

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Education

PhD , Queen Mary University of London, UK <i>'Topics in Extremal and Probabilistic Combinatorics'</i> , supervised by Robert Johnson	Sep 2016 – Aug 2020
BA with MMath , Trinity College, University of Cambridge, UK Distinction (Part III)	Oct 2012 – Jun 2016

Employment

University of Warwick , UK Research Fellow, working with Richard Montgomery	Nov 2023 – present
University of Victoria , Canada PIMS Postdoctoral Fellow, working with Natasha Morrison and Jonathan Noel	Jan 2022 – Oct 2023
Toronto Metropolitan University (formerly Ryerson) , Canada Postdoctoral Research Fellow, Graphs at Ryerson Research Group	Oct 2020 – Oct 2021

Research

My research interests are in extremal and probabilistic combinatorics. My work encompasses several different problems under this broad umbrella, including off-diagonal Ramsey multiplicity, thresholds for the anti-Ramsey problem, and a counting version of the Multidimensional Szemerédi Theorem. I am adept in the use of several cutting-edge techniques in combinatorics such as entropy, the hypergraph container method and Razborov's flag algebra method, as well as many standard tools that are specific to probabilistic combinatorics. I have successfully used these techniques to settle several interesting conjectures, as well as to develop a new theory on a natural generalisation of the existing concept of common graphs.

Please see separate list of publications for more information.

Awards and Funding

PIMS Postdoctoral Fellowship , University of Victoria	2022 – 2023
EPSRC Doctoral Studentship , Queen Mary University of London	2016 – 2020
Clay Mathematics Institute Funding US\$1,120 to support conference travel	Jul 2022
School of Mathematical Sciences Presentation Prize , Queen Mary University of London	2019
Ann Cook Poster Presentation Prize , Queen Mary University of London	2018
Undergraduate Summer Research Scholarship , Trinity College, Cambridge (£2000) <i>'The Representation Theory of the Symmetric Group'</i> , supervised by Stuart Martin	2015
Senior Scholar , Trinity College, University of Cambridge	2014

Talks

Invited Conference and Colloquia Talks

CanaDAM, Graph structure and decompositions minisymposium, University of Ottawa (upcoming)	May 2025
Colloquia in Combinatorics, UCL, <i>'Colour-biased Hamilton cycles in subgraphs of the random graph'</i>	May 2025
Scottish Combinatorics Meeting, University of Glasgow	May 2025
Liverpool Discrete Mathematics Colloquium, <i>'Ramsey multiplicity and Common pairs of graphs'</i>	Nov 2024
IBL60 (for Imre Leader's 60th birthday), University of Cambridge, <i>'Bounding cross-Sperner families'</i>	Sep 2023
CanaDAM, Combinatorics and algebra minisymposium, University of Winnipeg,	Jun 2023
MoCCA '20, Adventures in probabilistic and extremal combinatorics minisymposium, MIPT	Jul 2021

Invited External Seminar and Workshop Talks

The Open University (upcoming)	June 2025
University of Cambridge, ' <i>The rainbow saturation number</i> '	May 2025
TU Graz, ' <i>Colour-biased Hamilton cycles in subgraphs of the random graph</i> '	May 2025
University of Bristol, ' <i>Common pairs of graphs</i> '	Sep 2024
University of Oxford, ' <i>The rainbow saturation number</i> '	May 2024
University of Bristol, ' <i>Counting copies with containers</i> '	Jan 2024
Birmingham–Warwick Joint Combinatorics Day, ' <i>Counting copies with containers</i> '	Dec 2023
One World Combinatorics on Words Seminar, ' <i>Synchronizing times for k-sets in automata</i> '	Oct 2022
Young Researchers in Combinatorics workshop, ICMS ' <i>Subgraphs of semi-random graphs</i> '	Jul 2022
Cross-community Collaborations in Combinatorics workshop, BIRS	Jun 2022
PIMS Emergent Research Seminar, ' <i>Subgraphs in semi-random graphs</i> '	May 2022
University of Bristol, ' <i>Subgraph games in the semi-random graph process</i> '	Nov 2021
Graphs and Matroids Seminar via Matroid Union, ' <i>Subgraphs in semi-random graphs</i> '	Oct 2021
Queen Mary University of London, ' <i>Subgraphs in semi-random graphs (and hypergraphs)</i> '	Oct 2021
TU Ilmenau, ' <i>Subgraphs in semi-random graphs</i> '	Jul 2021
University of Bristol, ' <i>Synchronizing Times for k-sets in Automata</i> '	Apr 2021
Women in Combinatorics Virtual Colloquium, ' <i>Synchronizing times for k-sets in automata</i> '	Feb 2021
Workshop on Graph Theory & Combinatorics in Thuringia	Jul 2020
Birkbeck University of London, ' <i>Semi-perfect 1-factorizations of the hypercube</i> '	Oct 2019
LSE, ' <i>Semi-perfect 1-factorizations of the hypercube</i> '	Oct 2019
University of Bristol, ' <i>Semi-perfect 1-factorizations of the hypercube</i> '	Feb 2019
Open University Winter Combinatorics Meeting, ' <i>Semi-perfect 1-factorizations of the hypercube</i> '	Feb 2019
University of Warwick, ' <i>Hypergraph saturation irregularities</i> '	Oct 2018
University of Cambridge, ' <i>Hypergraph saturation irregularities</i> '	Feb 2018

Select Other Talks

British Combinatorial Conferences, QMUL/Lancaster/Durham/Strathclyde	Jul 2024/2022/2021/2019
Random Structures and Algorithms, Institute of European Culture in Gniezno	Aug 2022
BYMAT (Bringing Young Mathematicians Together)	Dec 2020

Workshops

Extremal and Probabilistic Combinatorics, ICMS (upcoming)	July 2025
Workshop on Spanning Subgraphs in Graphs (2), University of Warwick	Aug 2024
Early-Career Researchers in Combinatorics, International Centre for Mathematical Sciences	Jul 2024
Extremal Graphs and Hypergraphs, Institut Mittag-Leffler	Jul 2024
Algebraic, extremal, & struct. methods & problems in graph colouring, Sparse Graphs Coalition	Feb 2024
Workshop on Spanning Subgraphs in Graphs, University of Warwick	Jul 2023
Young Researchers in Combinatorics, International Centre for Mathematical Sciences	Jul 2022
Cross-community Collaborations in Combinatorics, Banff International Research Station	May 2022
Graduate Research Workshop in Combinatorics (online)	Jun 2021
Workshop on Graph Theory & Combinatorics in Thuringia (online)	Jul 2020

Teaching

Graph Theory – Masters course between 45 and 60 students Included lecturing, writing problem sheets, writing and marking the exam	Autumn 2023, Autumn 2024
Matrix Algebra I – 2nd year undergraduate course with approx. 130 students Included lecturing, office hours, writing homework assignments, writing and marking the exam	Autumn 2022

Teaching Assistant Roles

Random Processes – 3rd year undergrad course (running tutorials)	Autumn 2019
Calculus I – 1st year undergrad course (running tutorials, marking)	Autumn 2019
Coding Theory – 3rd year undergrad course (tutorial assistant, marking)	Spring 2019
Geometry I – 1st year undergrad course (running tutorials)	Spring 2018
Coding Theory – 3rd year undergrad course (tutorial assistant, marking)	Spring 2018
Differential and Integral Analysis – 2nd year undergrad course (tutorial assistant, marking)	Spring 2017

Research Students

Patrick Gaudart-Wiffling, Undergraduate Summer Research Project (upcoming)	2025
Marcus Carlsson, Masters Research Project (joint supervisor with Brett Kolesnik) <i>'An exploration of Markov chain Monte Carlo methods for random generation problems in combinatorics'</i>	2024 – 2025
Neil Mukerji, Masters Research Project <i>'Progress on the List Colouring Conjecture'</i>	2023 – 2024
Robert Phillips, MSc Extended Research Project <i>'Edge partitioning graphs of high degree'</i>	2023 – 2024

Select Outreach and Engagement

Imagining UVic , <i>'The Catalan Numbers'</i>	Oct 2022
Wrote and delivered 2 hour workshop for small group of girls aged 16–18.	
QMUL Girls in Maths Taster Days , <i>'Graph Theory'</i>	Mar 2019, 2020
Wrote and delivered 45 minute lecture to 140 girls aged 16–17.	
Royal Institution Mathematics Masterclass , QMUL, <i>'Geometry in the 4th Dimension'</i>	Feb 2019
Delivered a 2.5 hour masterclass for 90 children aged 16–17.	
LMS Newsletter Microthesis , <i>'Hypergraph Saturation Irregularities'</i>	Sept 2019
Invited to write exposition on part of my PhD work for the LMS newsletter.	
International Mathematical Olympiad , Coordinator	Jul 2019
Co-created a mark scheme, marked scripts and coordinated marks with team leaders.	
QMUL Year 11 Maths Summer Schools	2017, 2018, 2019
Wrote and helped to deliver three day extended research project on 'Codes and Ciphers' for ages 15–16.	
Wrote and delivered hour-long interactive class for 40 children on 'The Catalan Numbers'.	
Winchester Mathematics Summer School , <i>'Double Counting'</i>	2018
Wrote and delivered hour-long interactive class for 30 children aged 16–17.	
UKMT Summer Schools and 'Summer School for Girls' , <i>'Modular Arithmetic'</i> and <i>'Graphs'</i>	2013 – 2018
Wrote and delivered 1.5-hour interactive classes for groups of 20 to 30 children aged 13–16.	
UKMT Maths Circles , <i>'The Catalan Numbers'</i>	2016, 2018
Wrote and delivered 1.5-hour interactive classes for 30 children aged 13–15.	
UKMT Mentoring Scheme	2012 – 2020
Mentor for gifted children aged 16–18, via email correspondence.	

Administrative Experience and Academic Service

Organiser , Early Career Mathematicians in Combinatorics Workshop, ICMS	2024
In addition to scientific organising, the organising committee secured £36,500 in funding from various sources:	
<ul style="list-style-type: none">• £24,000 and hosting from the ICMS• £4,000 from the Heilbronn Institute,• £3,000 from the London Mathematical Society,	<ul style="list-style-type: none">• £3,000 from the Glasgow Math. Journal Trust,• £1,500 from the Edinburgh Mathematical Society,• £1,000 from the British Combinatorial Committee.
Organiser , Warwick Combinatorics Seminar	2024 – 2025
Supervisor , Royal Institution Mathematics Masterclasses, QMUL	2018, 2019
Included directing undergraduate volunteers, liaising with speakers, setting up and child safety.	
Clearing hotline adviser , QMUL, with particular responsibility for non-standard cases	2018, 2019
Organiser , Queen Mary Postgraduate Seminar	2017–2018
Journal referee For <i>JCTA</i> , <i>JCTB</i> , <i>Eur. J. Combin.</i> , <i>SIAM J. Discrete Math.</i> , <i>Combinatorica</i> , <i>Electron. J. Comb.</i> , <i>Discrete Mathematics</i> , and <i>Mathematika</i> .	2018 – present
Treasurer , Emmy Noether Society – student society to promote women in mathematics.	2014
Secured an LMS Small Grant for Education for the society.	

Other Skills

Professional Programming Experience	Software developer at Metaswitch for summers of 2013 and 2014.
Was awarded a bonus and a paid scholarship to return for a second summer.	
Music	ABRSM Grade 8 piano and violin